WHAT IS CLAIMED IS:

1. A method of detecting and locating noise sources each emitting a respective signal S_j with $j = 1$ to M, detection being provided by means of acoustic wave or vibration sensors each delivering a respective time-varying electrical signal s_i with i lying in the range 1 to N, the method consisting:

· in taking the time-varying electrical signals delivered by the sensors, each signal $s_i(t)$ delivered by a sensor being the sum of the signals S_j emitted by the noise sources;

· in amplifying and filtering the time-varying electrical signals as taken;

· in digitizing the electrical signals;

· in calculating the functional f, such that:

$$f(\boldsymbol{n}_1, \ldots, \boldsymbol{n}_j, \ldots, \boldsymbol{n}_M) = \frac{\det(<\boldsymbol{T}_k(\omega), \boldsymbol{T}_l^*(\omega)> \quad k,\ l = 0 \text{ to } M)}{\det(<\boldsymbol{T}_k(\omega), \boldsymbol{T}_l^*(\omega)> \quad k,\ l = 1 \text{ to } M)}$$

with

$$(\boldsymbol{T}_k(\omega))_i = e^{J\omega\frac{<\boldsymbol{n}_k, \boldsymbol{c}_i>}{c}}$$

<.,.> being the scalar product;

.. $\boldsymbol{c}_i$ being the vector constructed between the center of gravity of the sensors and the position of sensor i;

.. $\boldsymbol{n}_j$ being the unit vector in the direction defined by the center of gravity of the senors and source j;

.. with $\boldsymbol{T}_0 = \boldsymbol{s}$; and

.. with c = the speed of sound; and

· in minimizing the functional f relative to the vectors $\boldsymbol{n}_j$ for $j = 1$ to M in such a manner as to determine the directions $\boldsymbol{n}_j$ of the noise sources.

2. A method according to claim 1, wherein, in order to minimize the functional f when the noise sources are narrow band sources, the method consists:

· in calculating the Fourier transforms of the signals $s_i(t)$ delivered by the sensors;

· in using the expressions for the determinants of the matrices of general term:

$$< \boldsymbol{T}_k(\omega), \boldsymbol{T}_1^*(\omega) >$$

to calculate the functional:

$$f_1 = \sum_k \|\boldsymbol{B}(\omega)_k\|^2$$

· and after selecting a determined number of noise sources, in minimizing the functional f_1 to determine the directions $\boldsymbol{n}_j$ of the selected noise sources.

3. A detection method according to claim 1, wherein, in order to minimize the functional f when the noise sources are broad band, the method consists:

· in calculating the Fourier transforms of the signals $s_i(t)$ delivered by the sensors;

· in using the expressions of the determinants of the matrices of general term:

$$< \boldsymbol{T}_k(\omega), \boldsymbol{T}_l^*(\omega) >$$

to calculate the functional:

$$f_2 = \int \|\boldsymbol{B}(\omega)\|^2 d\omega$$

· and after selecting a determined number of noise sources, in minimizing the functional f_2 to determine the directions $\boldsymbol{n}_j$ of the selected noise sources.

4. A detection method according to claim 1, wherein, in order to minimize the functional f, the method consists:

· in simplify the expression for the functional f to minimize the following functional f_3:

$$f_3 = \int \det(< \boldsymbol{T}_k, \boldsymbol{T}_l^* > \quad k,\ l = 0 \text{ to } M)\, d\omega$$

· in calculating the cross-correlation functions γ_{ij} of the signals s_i and s_j; and

· after selecting a determined number of noise sources, in minimizing the functional f_3.

5. A detection method according to claim 1, wherein, after the minimization operation, the method consists in calculating the source vector:

$$\boldsymbol{S}(\omega) = ({}^{t}T^{*}.T)^{-1}.{}^{t}T^{*}.\boldsymbol{s}(\omega)$$

in order to discover the characteristics of the noise sources.